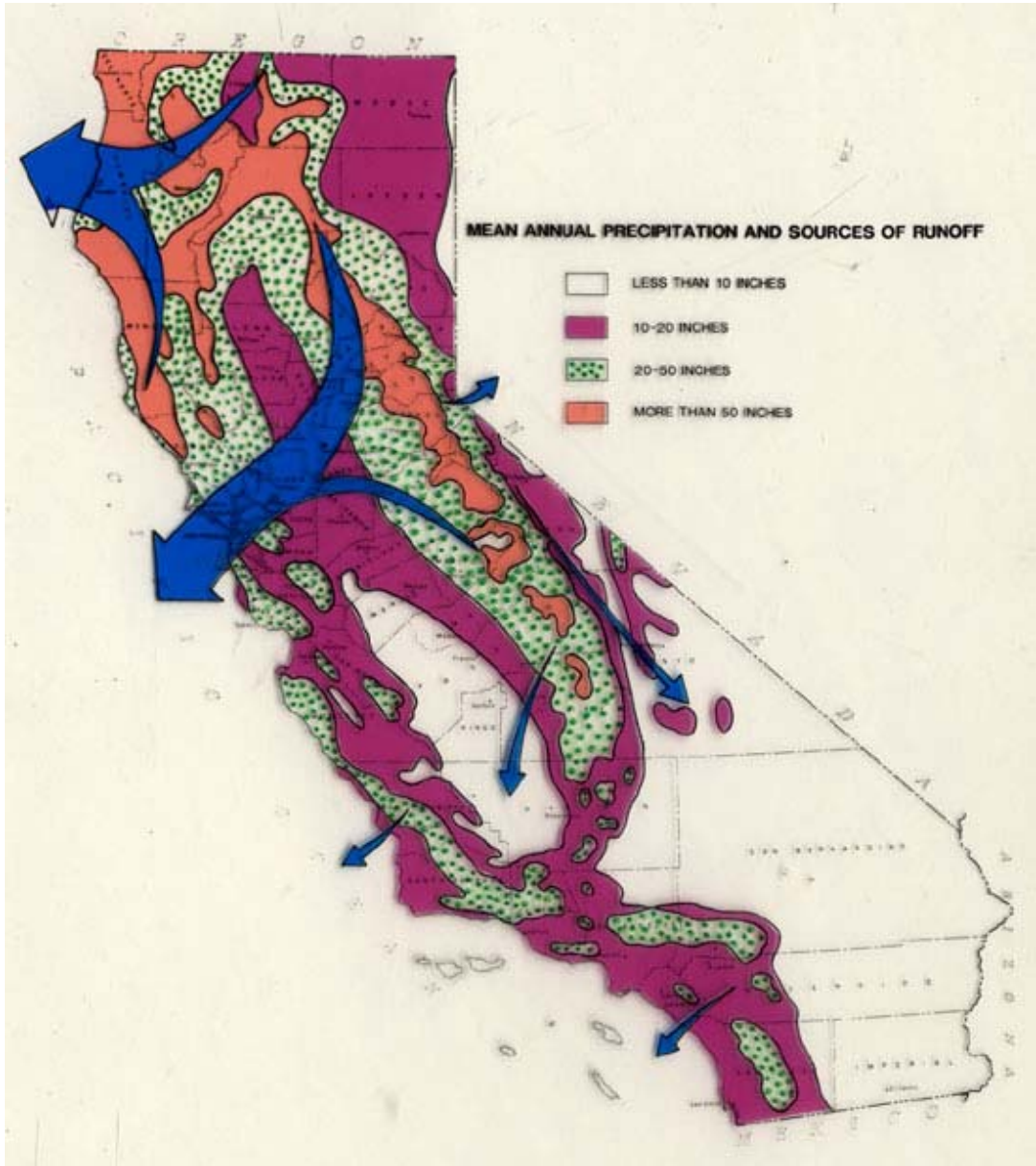
# Economic Benefits from Hydrologic Forecasting & Data Collection

# Statewide Hydrology



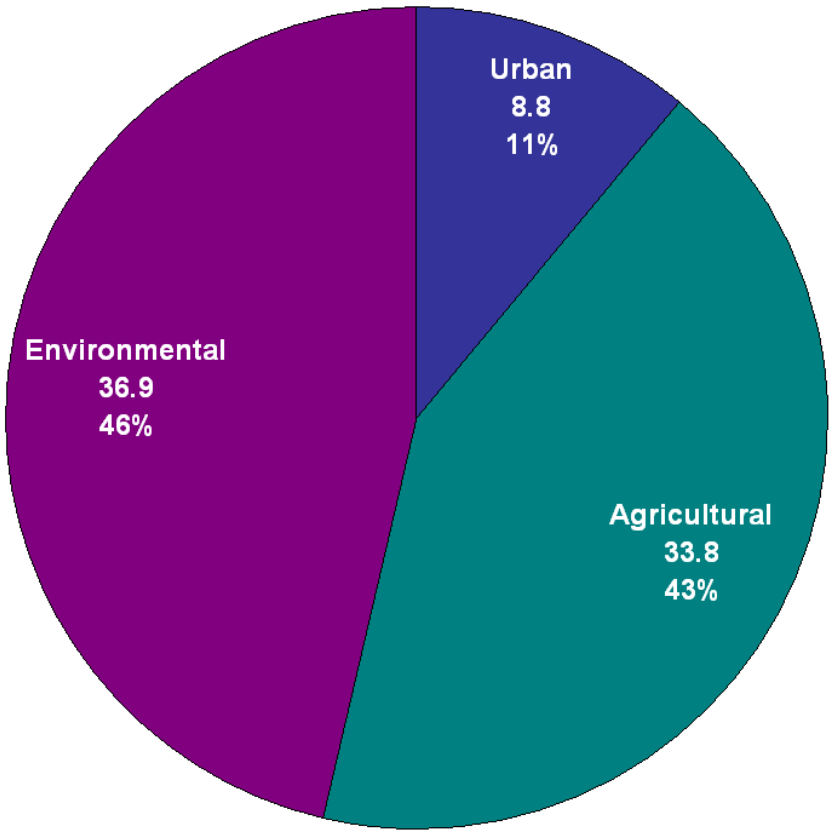
# Hydrology Interests

- Economic Interests
  - Water Supply
  - Hydropower
  - Flood Damage Reduction
- Other Interests
  - Public Safety
  - Watershed Management
  - Fishery & Forestry
  - Recreation

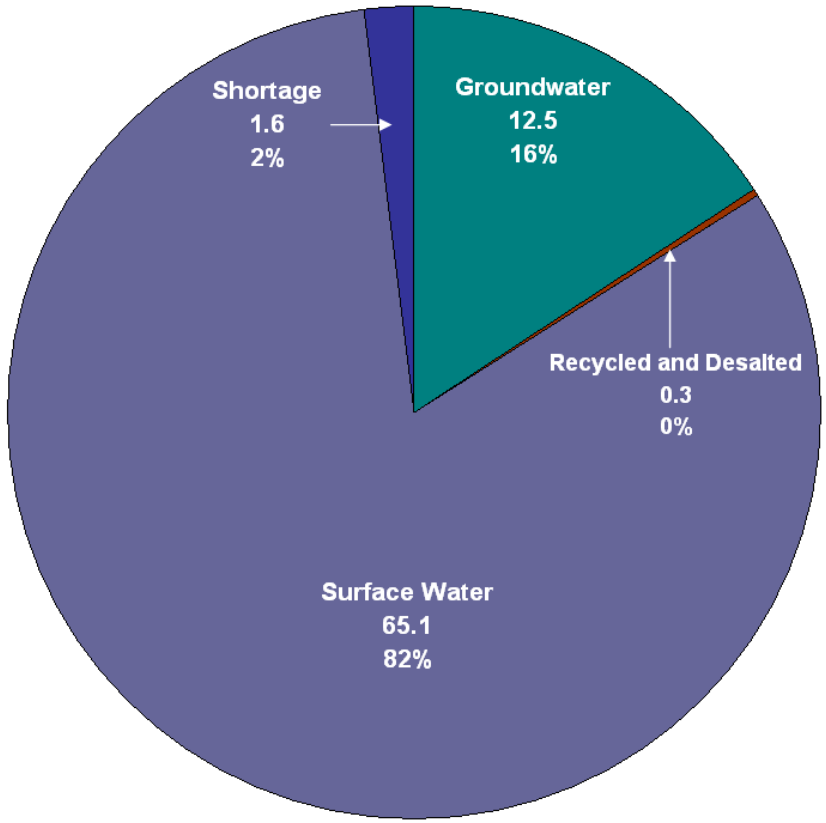
# California Water Budget w/ Existing Facilities & Programs

**1995 Total Average Applied Water = 79.5 MAF**

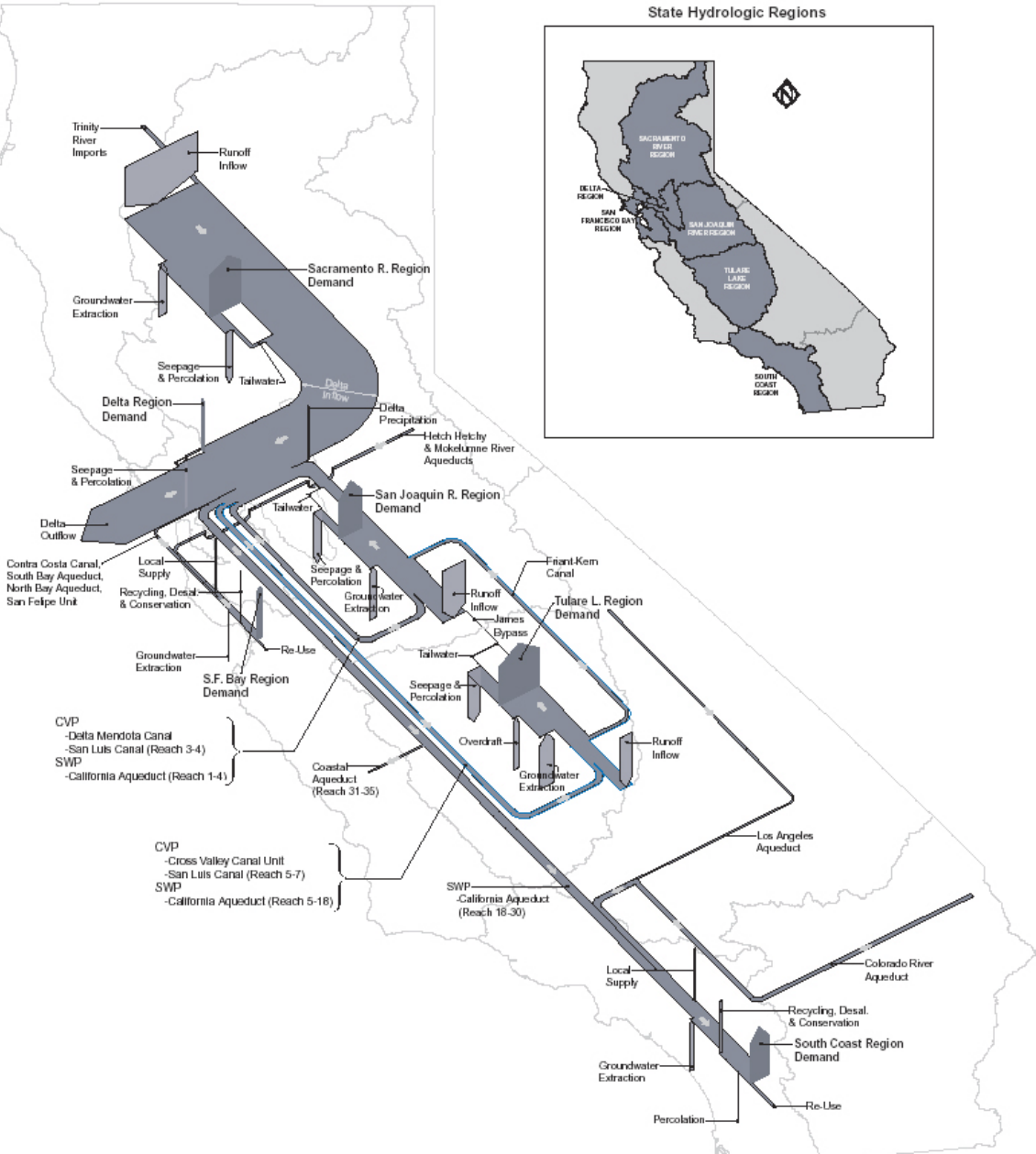
Water Use



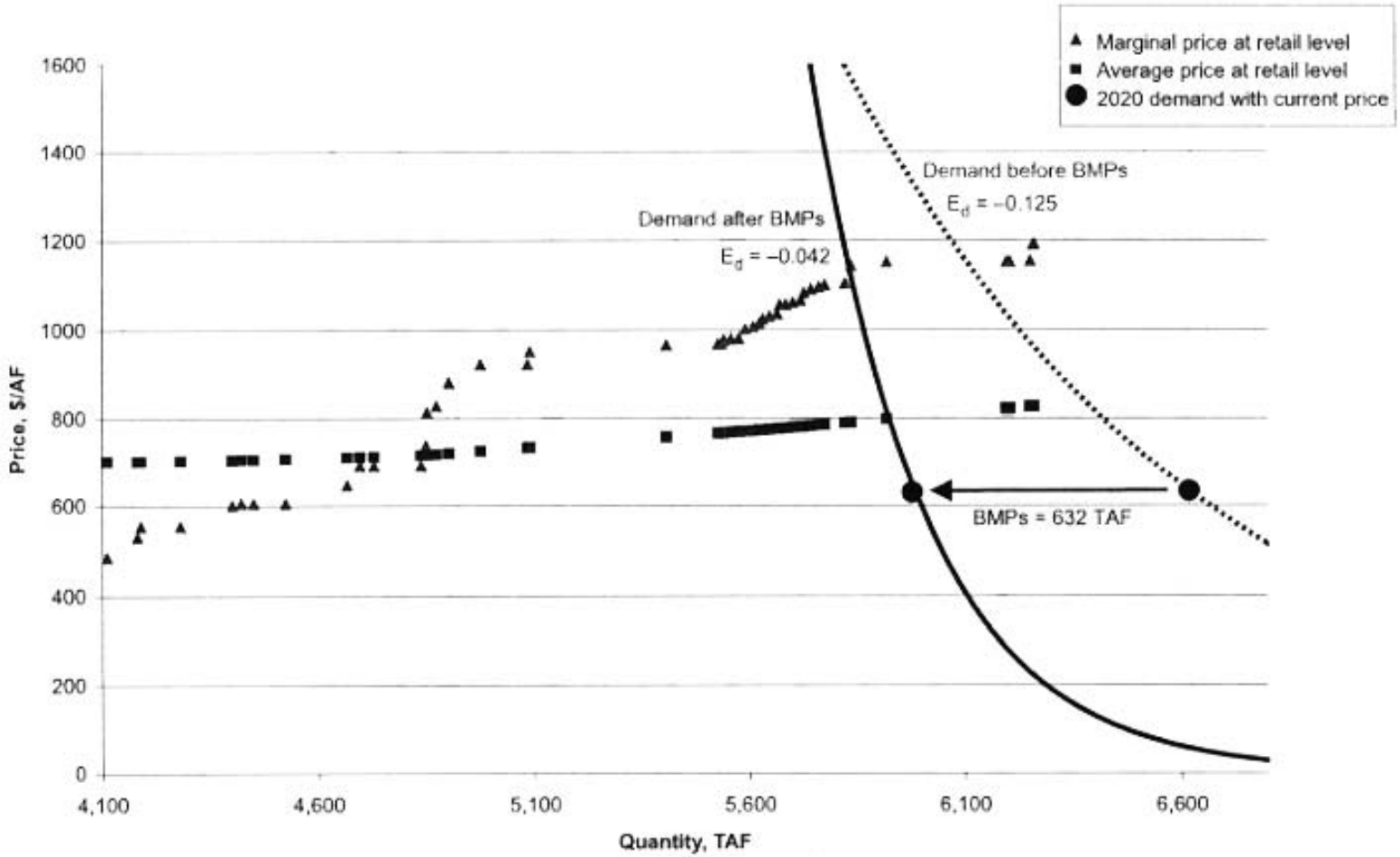

Supplies



# Statewide Water Management Schematic



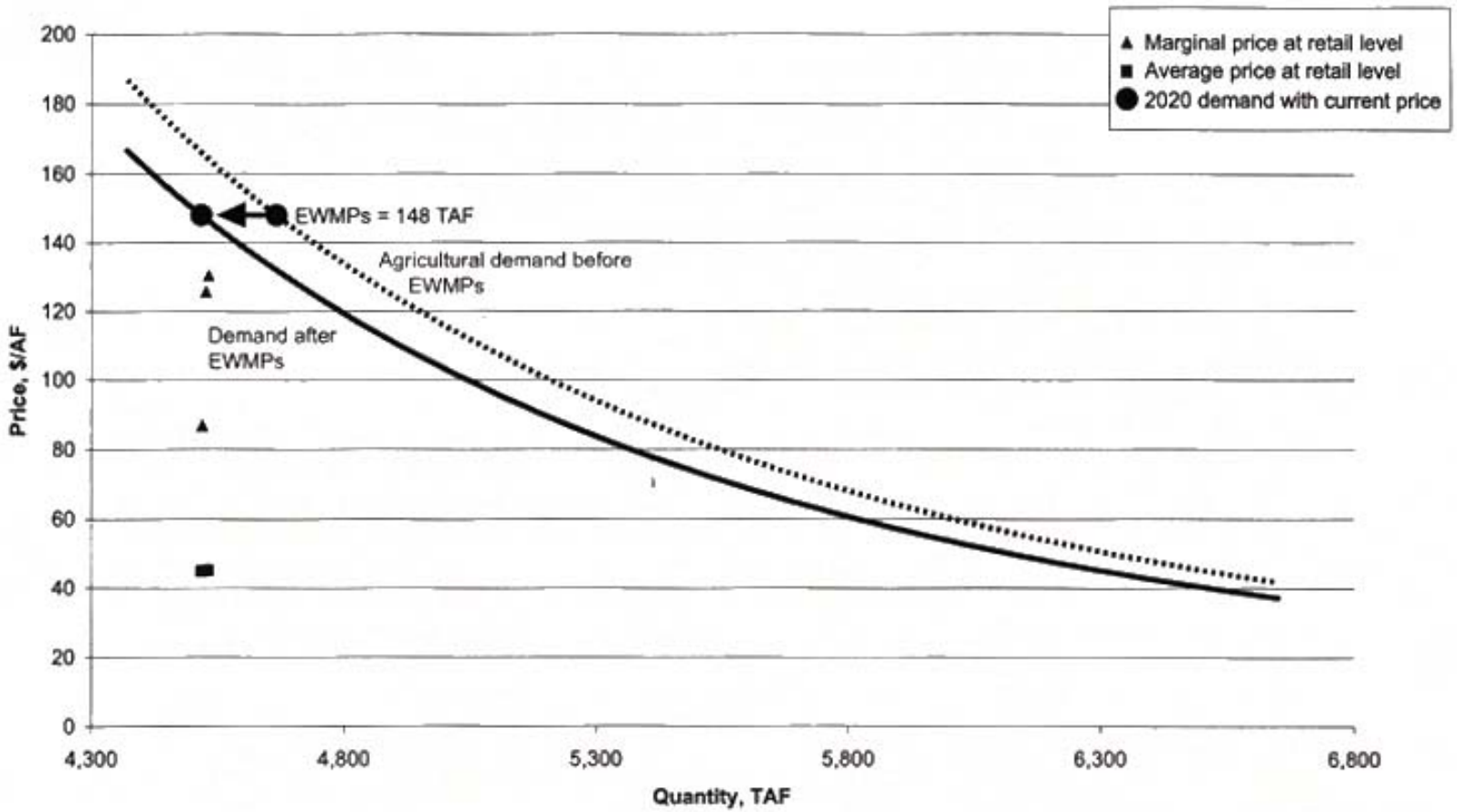
# Regional Demand-Supply – South Coast




Economic Evaluation of Water Management Alternatives (CALFED 1999)

*Chart 47*
***Screening Level Analysis***
***No Conjunctive Use Sensitivity Analysis***
***South Coast Region***

# Regional Demand-Supply – San Joaquin Valley




Economic Evaluation of Water Management Alternatives (CALFED 1999)

*Chart 4*
***Screening Level Analysis***
***Unconstrained Preference Set***
***San Joaquin River Region***

# Water Supply Economics

- Water Supply [1]
  - Approx. $3 to $4 Billion per year
  - Forecasted Runoff Average – 32 MAF
  - Municipal – Retail $200 - 600 /AF
    - Central Valley estimated @ $200 / AF
    - Bay Area estimated @ $300 / AF
    - South Coast estimated @ 600 / AF
  - Agricultural – Average Cost $15 - $50 /AF
    - Sacramento Valley estimated @ $15 / AF
    - San Joaquin Valley estimated @ $30 / AF
    - Tulare estimated @ 50 / AF

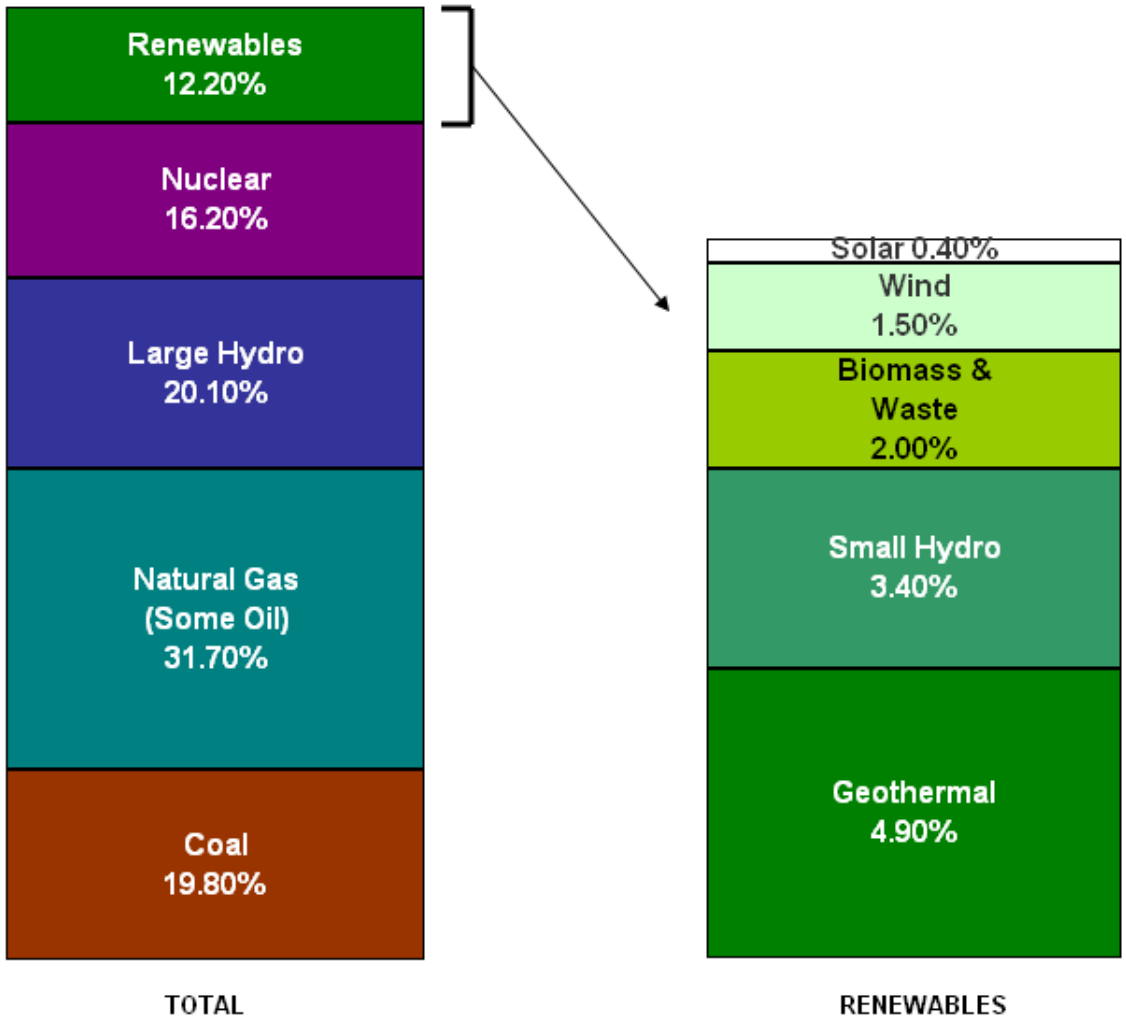
Footnotes:

1) Bull 160-98; Economic Evaluation of Water Management Alternatives (CALFED 1999)

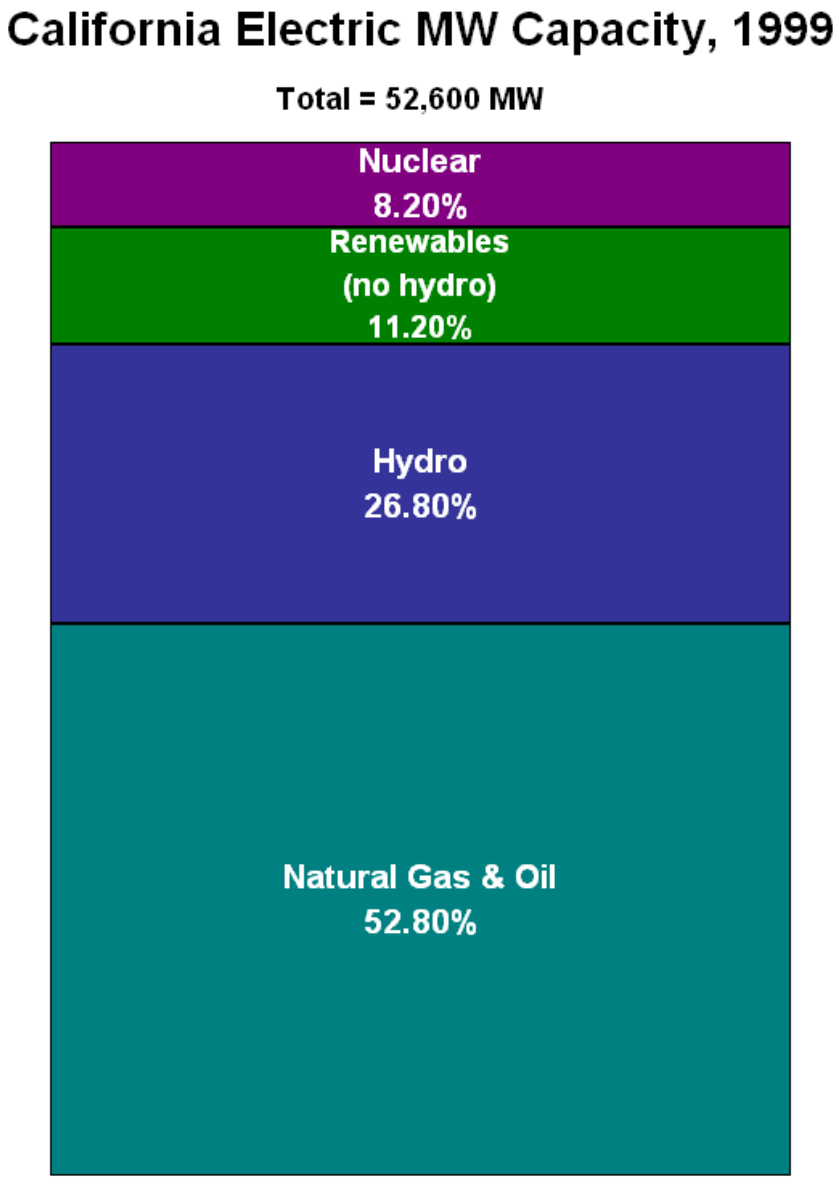
# California Energy Budget

## Sources of 1999 California Net System Electricity

**Total = 239 Billion KWH**



# California Energy Capacity



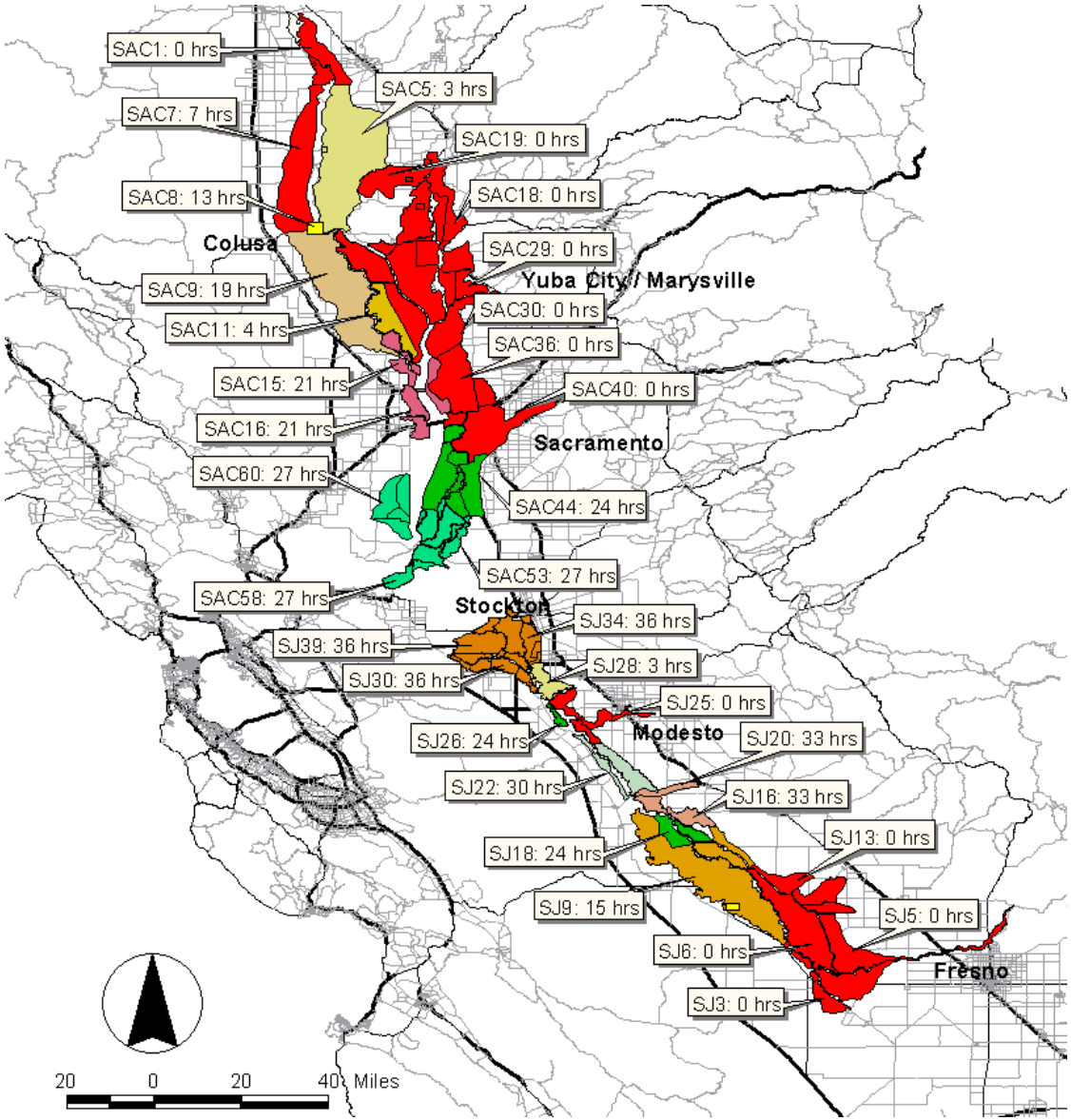
# Hydroelectric Economics

- Hydroelectric [1]
  - Approx. $0.7 to $1.0 Billion per year
  - Statewide Hydro Facility Capacity – 32,000 MW
  - Representative Hydro Facility Capacities
    - Pitt/McCloud - 768 MW
    - Upper Feather – 851 MW
    - Upper American – 952 MW
    - Upper Stanislaus – 478 MW
    - Upper San Joaquin – 1,221 MW
  - Power Rates – $20 - $40 /Mwh

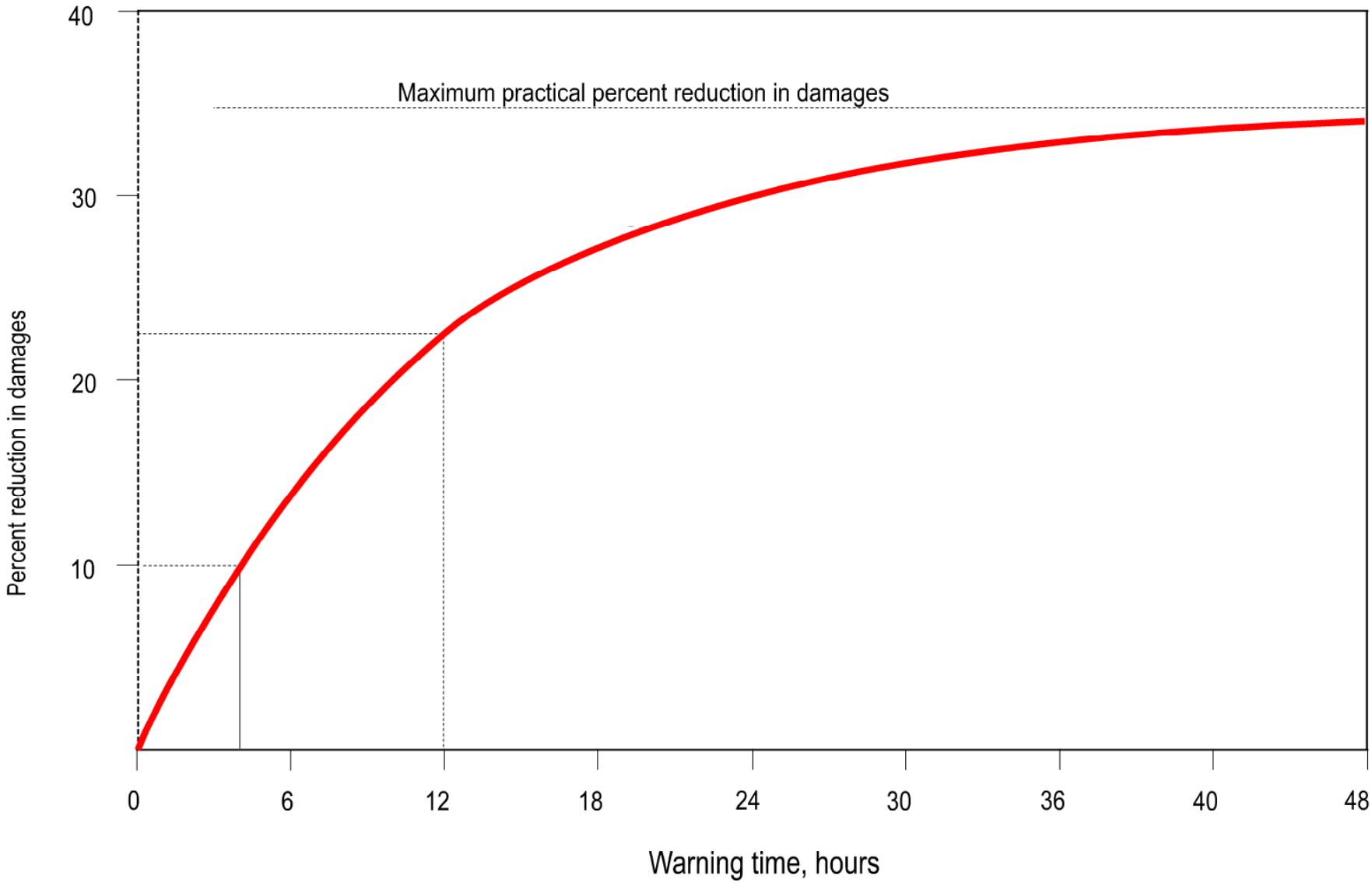
- Footnotes:

1) Based on B-194 (DWR); energy market update from DWR's Calif. Energy Resource Scheduling Division (CERS)

# Flood Damage Reduction Economics



# Flood Damage Reduction Economics



# Flood Damage Reduction Economics

- Flood Reduction [1]
  - Sac/SJ Building Value - $35 Billion
  - Sac Expected Annual Damage – $164 million
  - SJ Expected Annual Damage - $88 million

Footnotes:

1) The Comprehensive Study in-progress review document (USACE 2000) Appendix I

# Annual Benefits from Hydrologic Forecasting

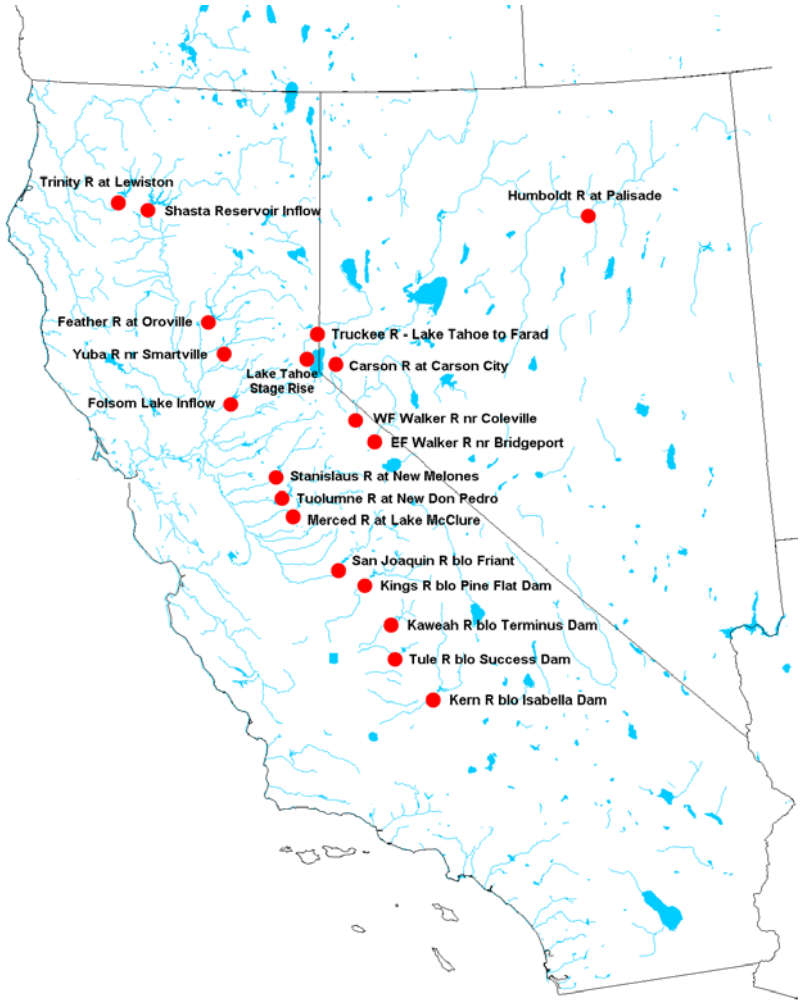
- National Annual Average Benefits of Hydrologic Forecasts
  - Optimum Reservoir Operations – $1.022 ($B)
  - Short-Term Forecasts - $0.433 ($B)
  - Long-Term Forecasts - $0.163 ($B)
- Calif.-Nevada Annual Average Economic Benefits
  - Irrigation/Water – $49.3 ($M)
  - Hydroelectric – $13.6 ($M)
  - Flood Reduction Benefit – $18.9 ($M)
  - Navigation - $0 ($M)

Footnote:

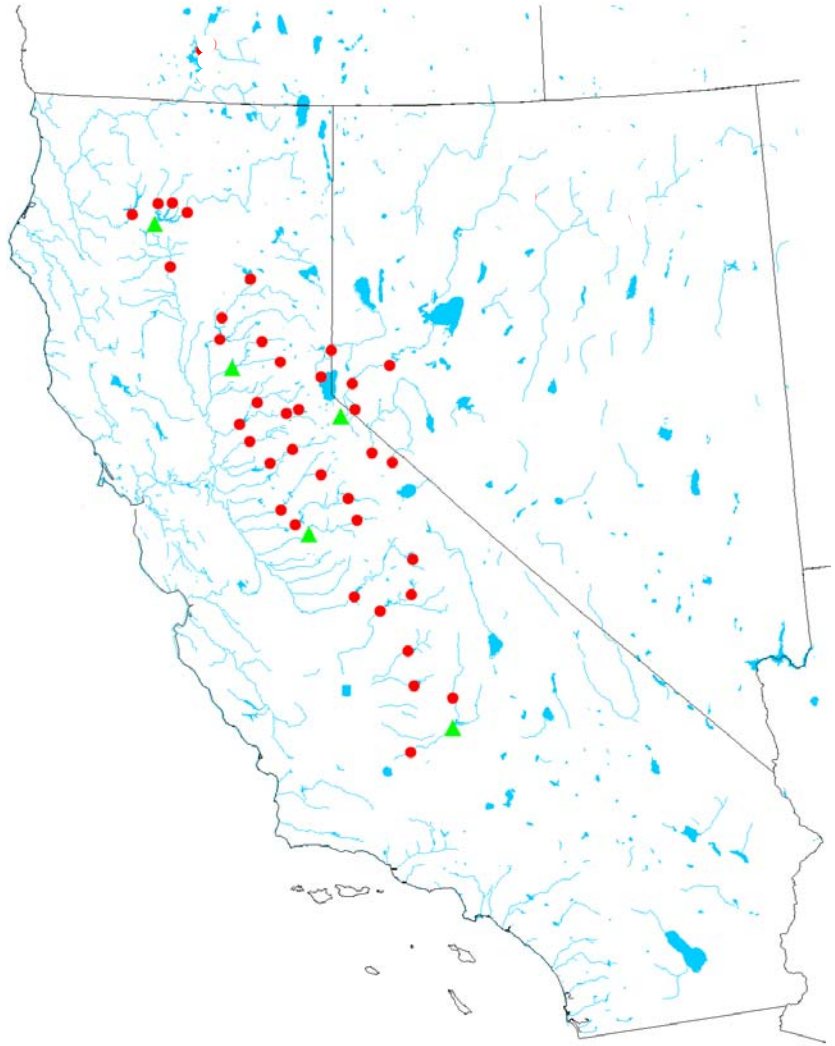
Based on "Use and Benefits of the National Weather Service River and Flood Forecasts" (National Hydrologic Warning Council 2002)

# Water Supply Forecast Locations

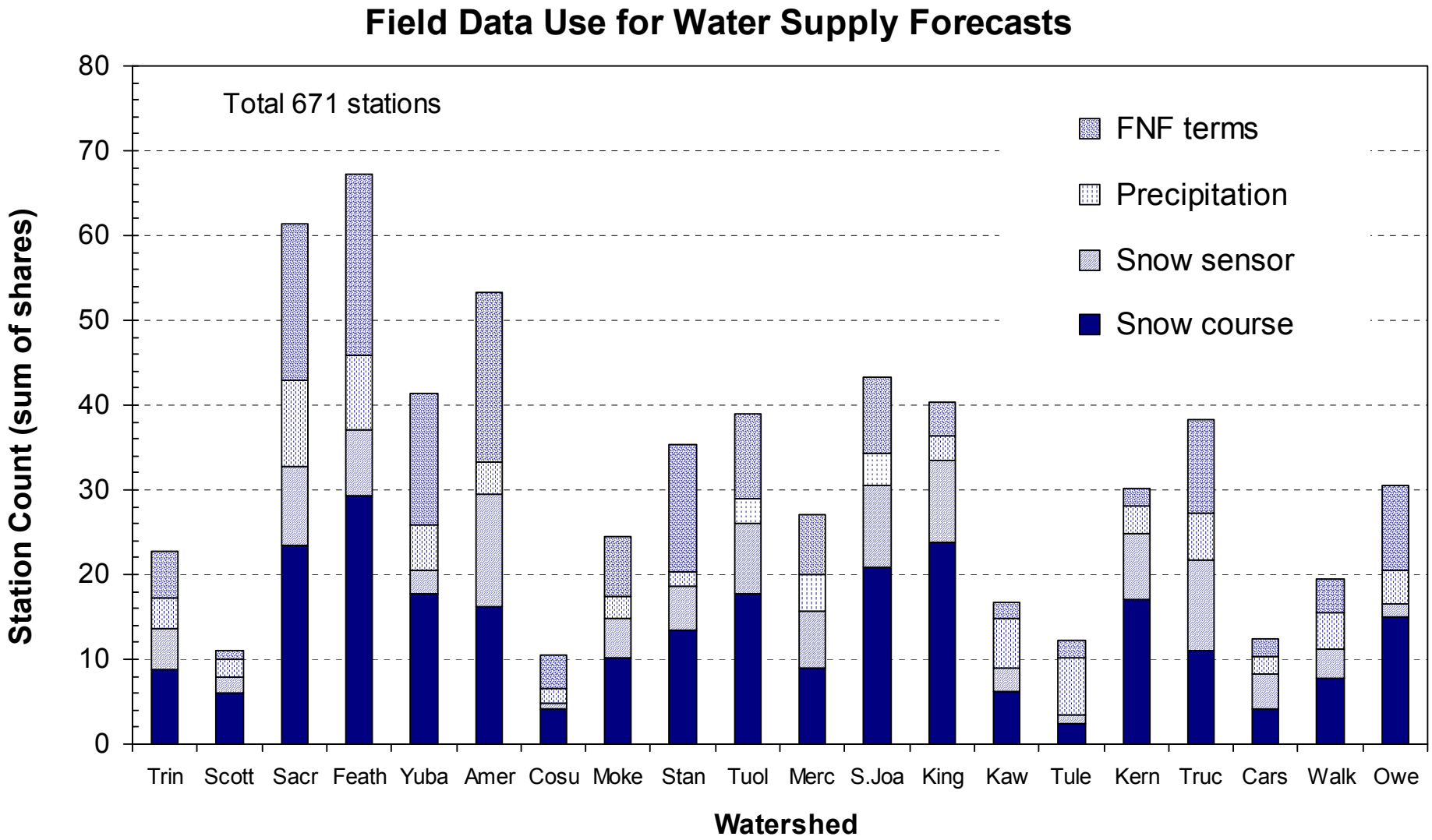
- Snowmelt Runoff Points




- Water Supply Forecast Points



# Water Supply Forecast Data



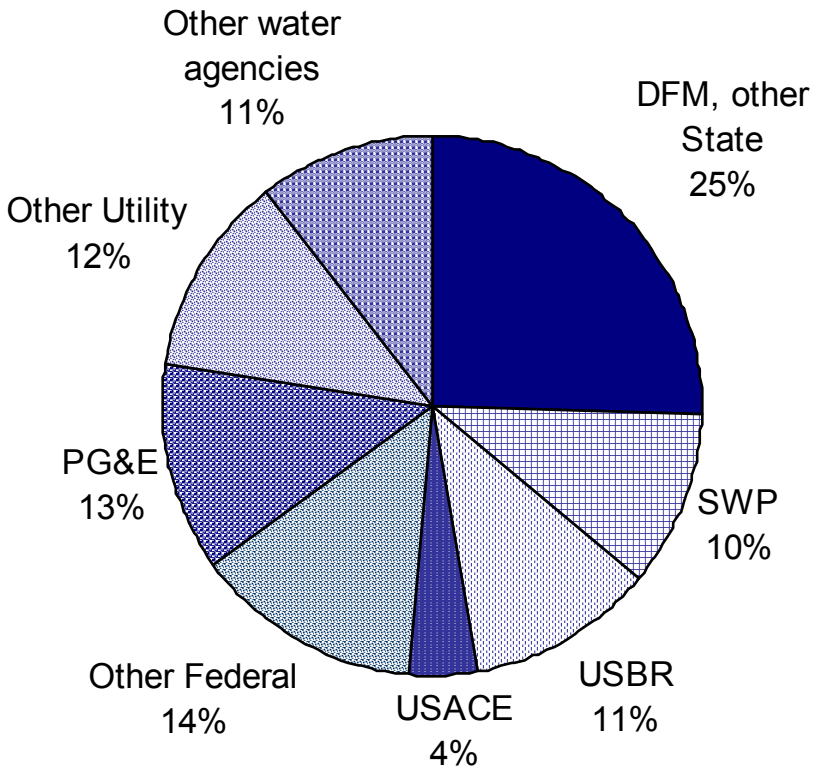
# Field Data Costs

- Components of Field Data Costs
  - Data Measurement
  - Site Maintenance
  - Data Acquisition & Filing (Elec. Exchange & Database) + CCSS Coordination
- Annual Average Unit Rate Assumed
  - Precipitation Observation - $4,700
  - Precipitation Telemetry – $4,000
  - Snow Course - $2,300
  - Snow Sensors – $5,100
  - Streamgaging - $17,800
  - FNF Terms - $7,500

# Supply Forecast Cost Breakdown

**Total Support**
**(% of all data, DWR forecasting cost)**

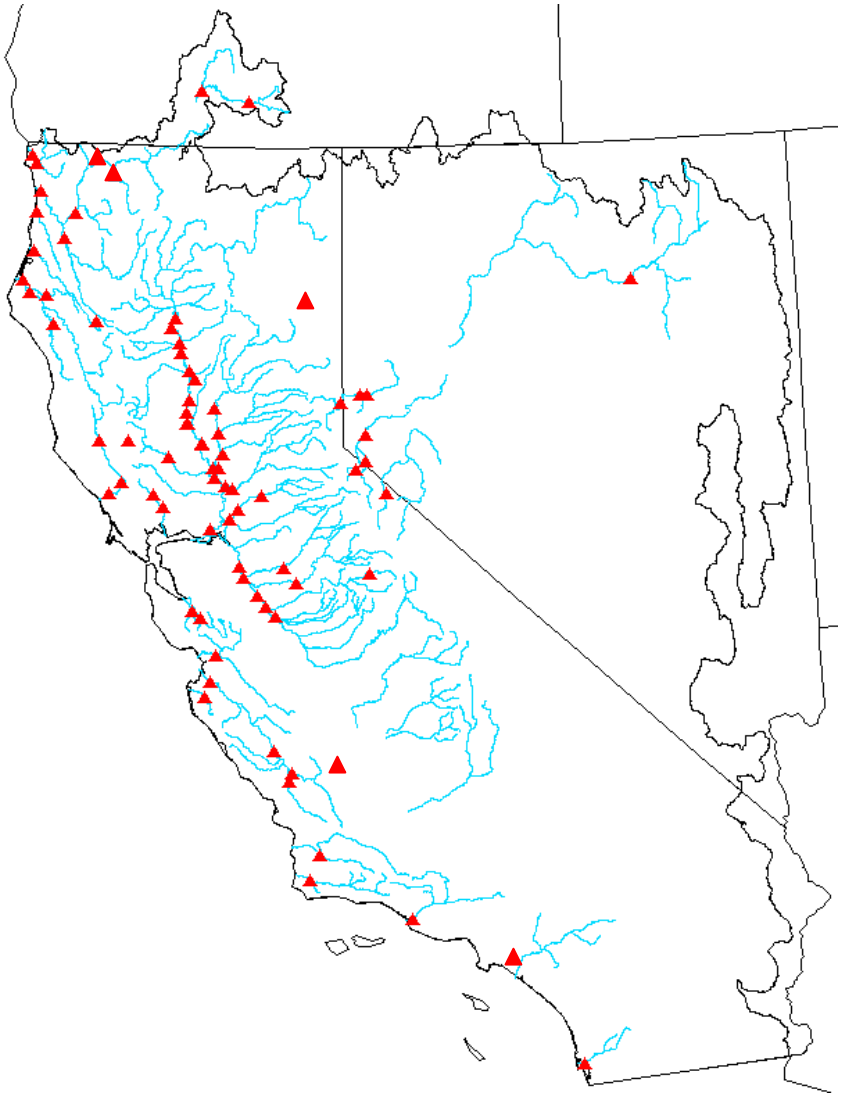
Total Est. @ $3.8 million/year



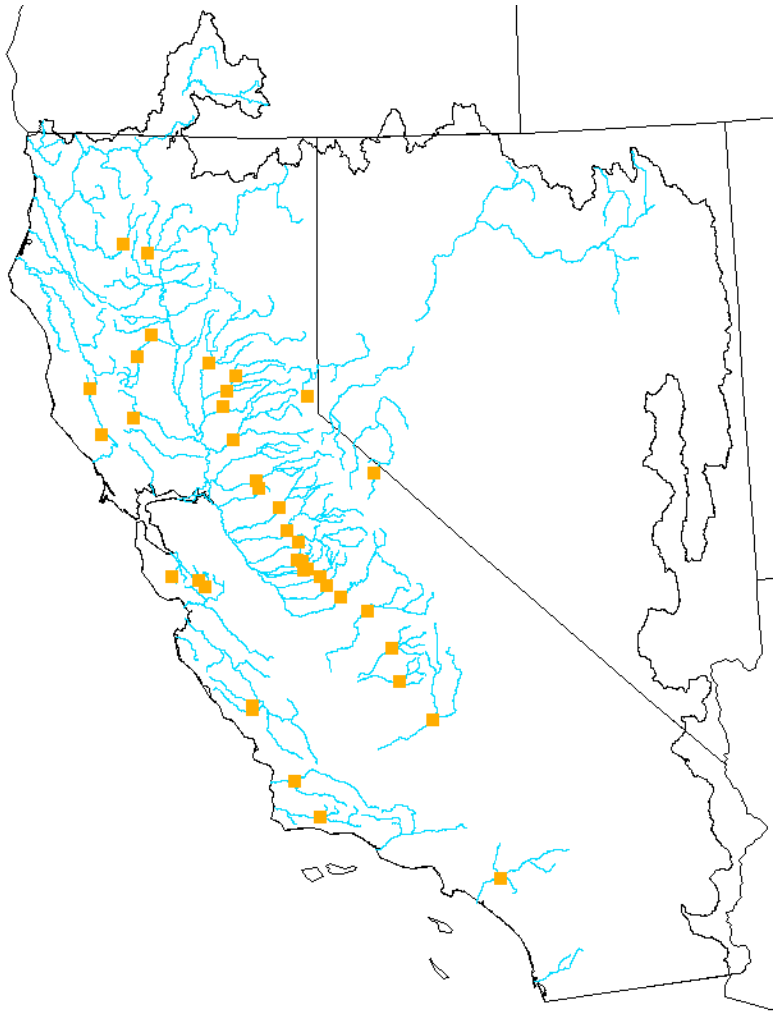

Includes precipitation & stage data required for other purposes than WS forecasting

# Flood Forecast Locations

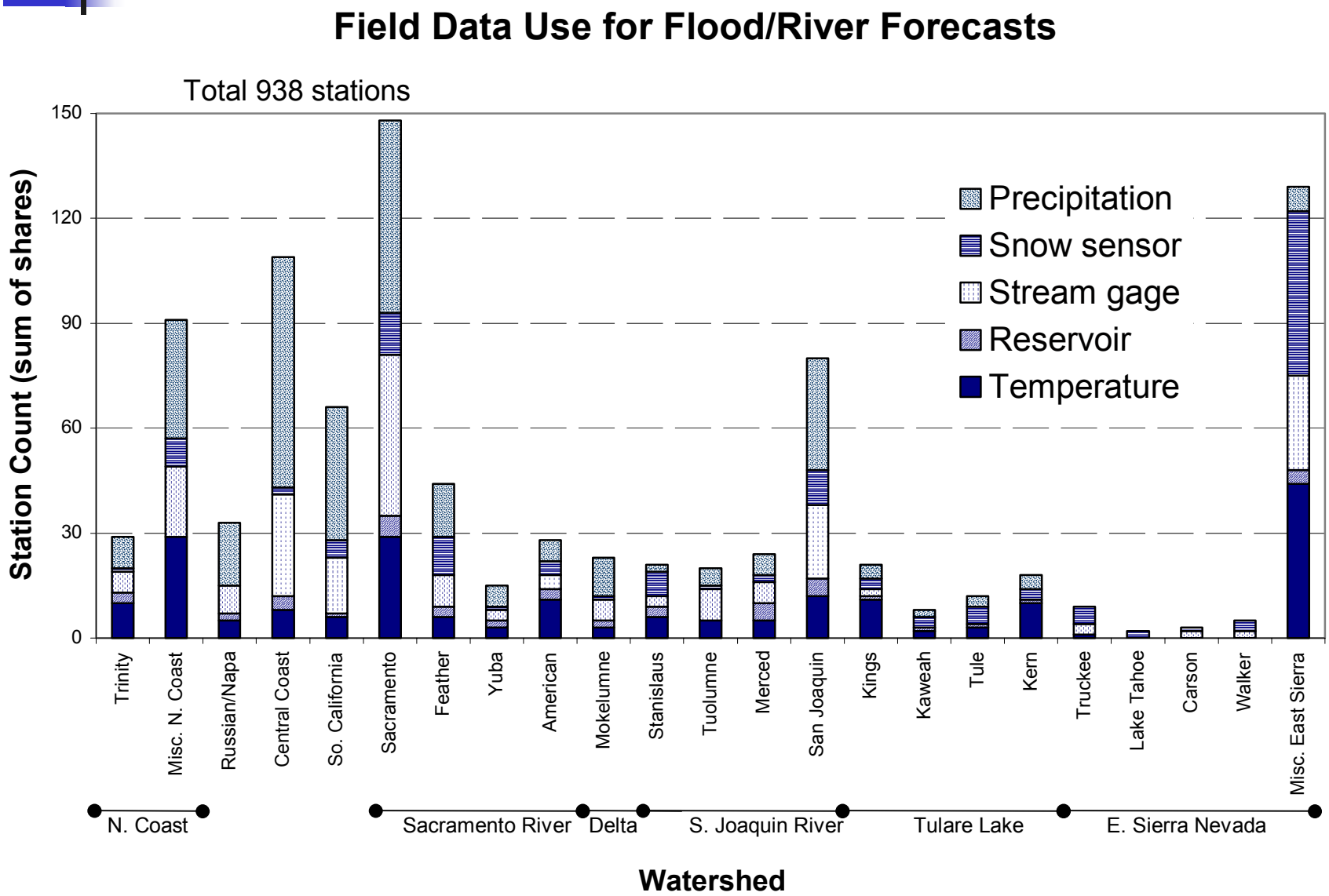
- River Forecast Points



- Reservoir Forecast Points



# River/Flood Forecast Gages

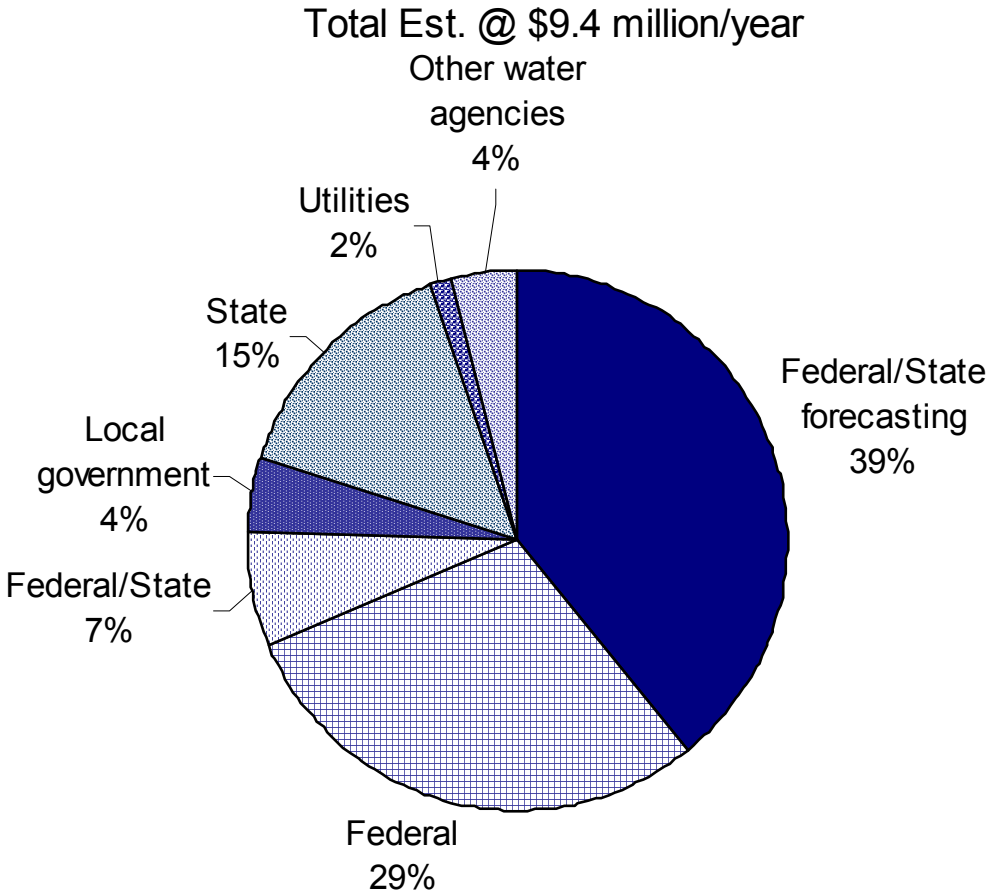


# Field Data Costs

- Components of Field Data Costs
  - Data Measurement
  - Site Maintenance
  - Data Acquisition & Filing (Elec. Exchange & Database) + Forecast Section Coordination
- Annual Average Unit Rate Assumed
  - Precipitation Telemetry – $4,000
  - Temperature - $500
  - Snow Sensors – $5,100
  - Streamgaging - $17,800
  - Reservoir - $500

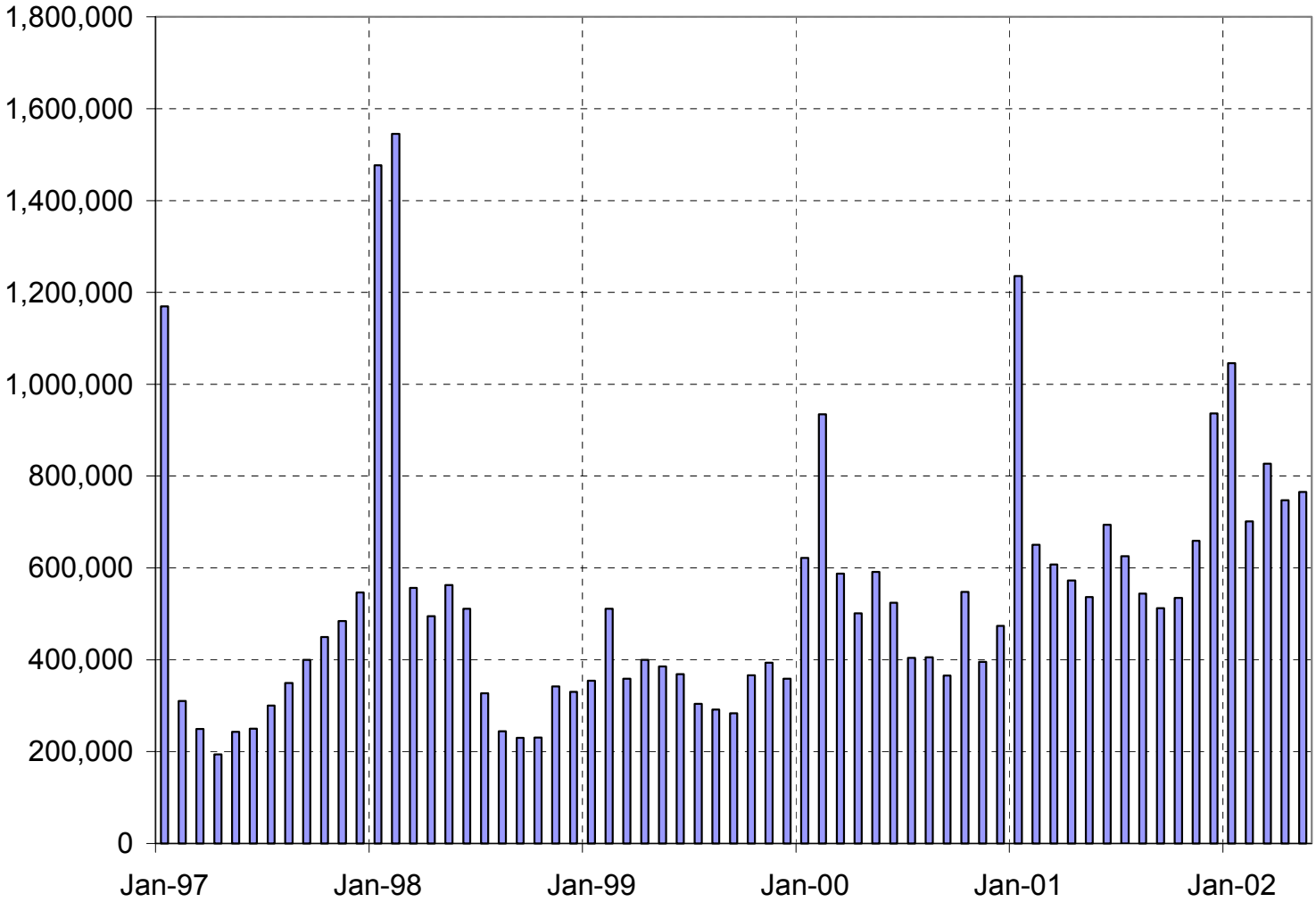
# Flood Forecast Cost Breakdown

**Total Support**
**(% of all data,CNRFC/DWR forecasting cost)**

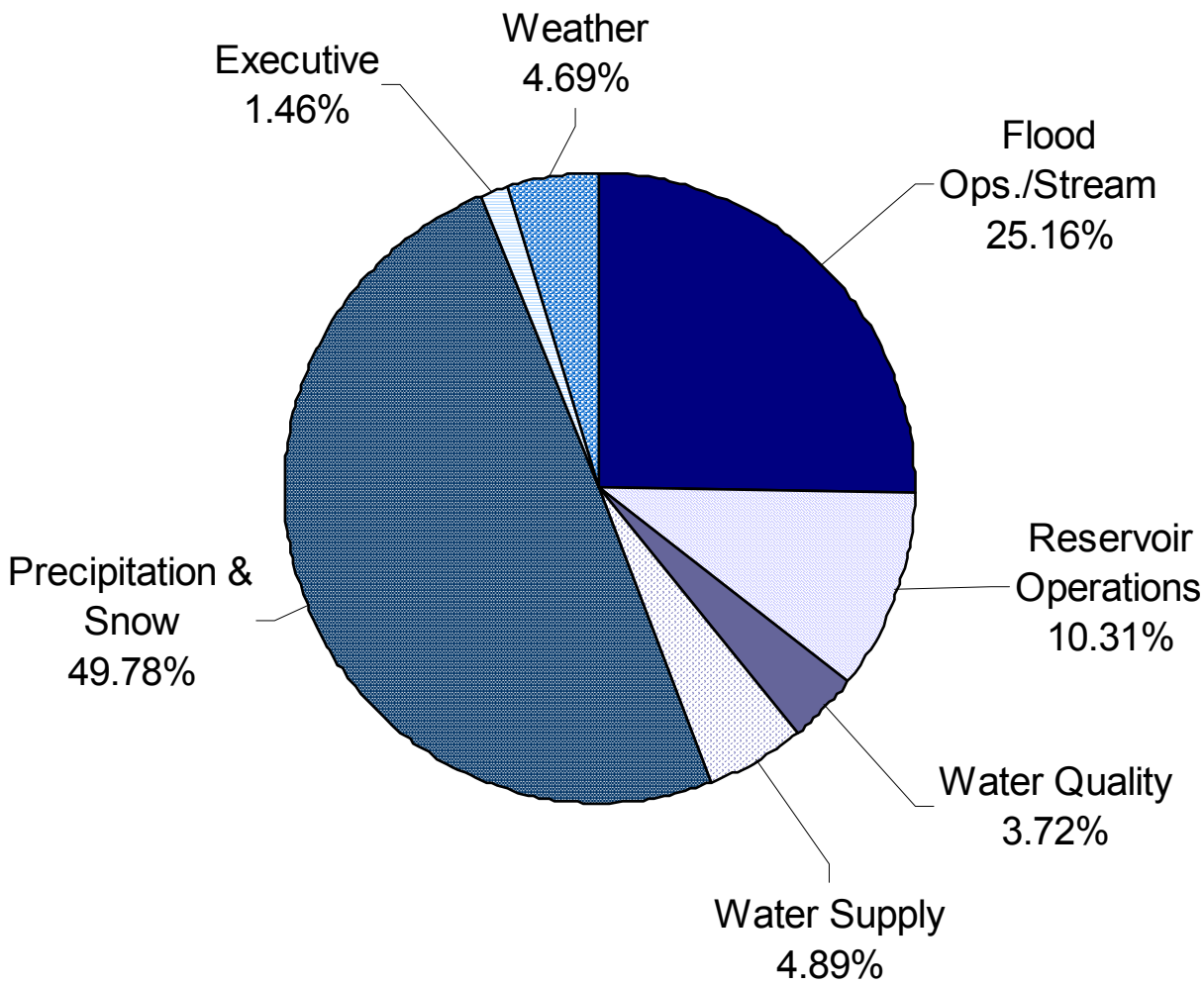



Includes precipitation & stage data required for other purposes than Flood forecasting

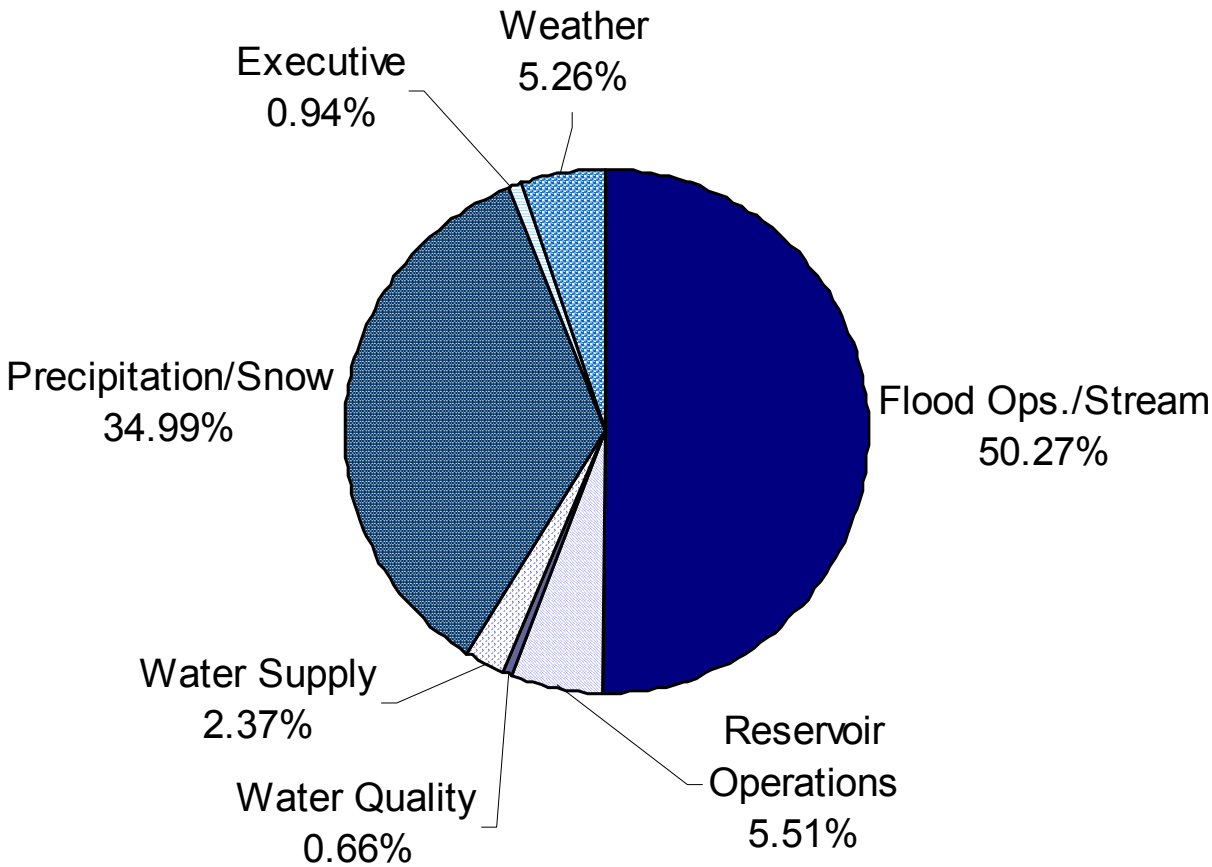
# Calif. Operational Hydrology – Monthly CDEC Queries



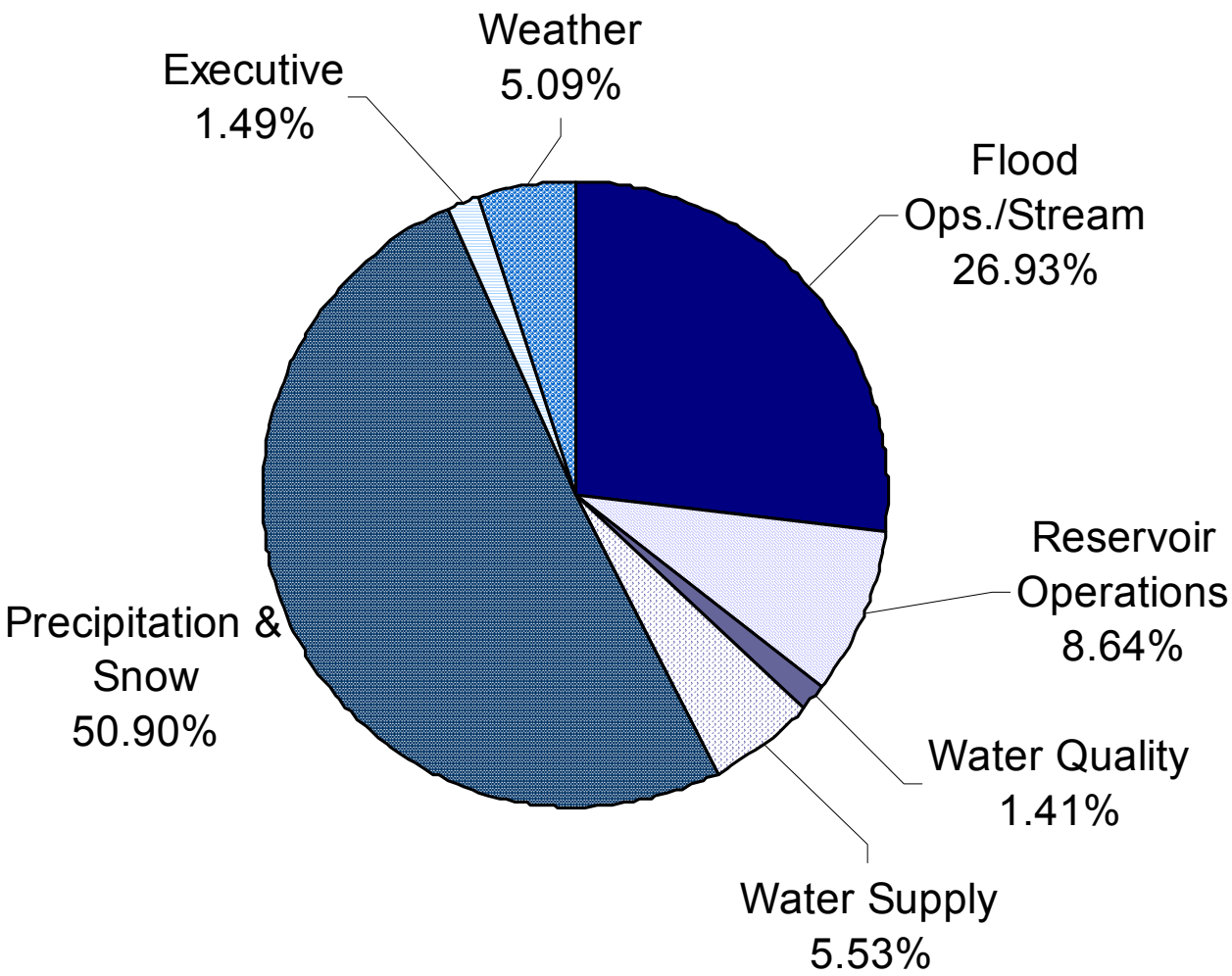
# CDEC Access for July 2002 by Product Type



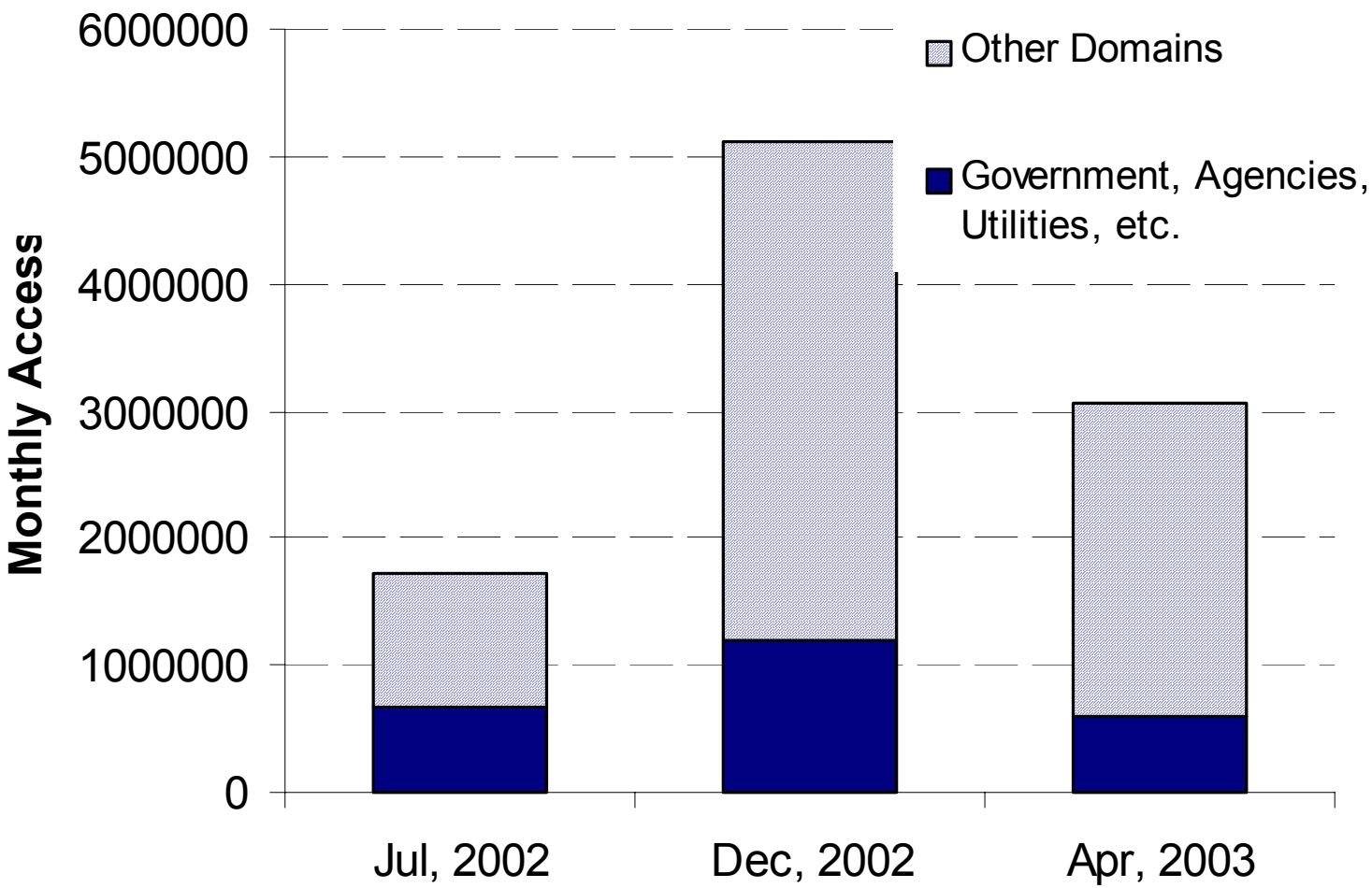
# CDEC Access for Dec 2002 by Product Type



# CDEC Access for Apr 2003 by Product Type



# CDEC Web Access



# Cooperative Snow Survey Program – Historical Perceptive

| | |
|---|---|
| 1908 | Dr. James E. Church invents Mt. Rose Snow Sampler |
| 1910 | First snow course data recorded in Lake Tahoe Basin |
| 1917 | Church publishes full account of surveying techniques and funding for California Surveys approved through 1923 |
| 1923 | LADWP begins snow surveys in Owens Basin |
| 1929 | AB 403 creates California Cooperative Snow Surveys with funding through 1933 |
| 1930 | First published April 1 forecasts |
| 1933 | Soil Conservation Service founded and first meeting of the Western Snow Conference |
| 1934 | No forecasts made for 1934 & 35 due to lack of funding. Cooperators continue to fund data collection |
| 1935 | AB 1000 refunded forecasting |
| 1939 | SCS assumes Federal responsibility for snow surveys |
| 1943 | Snow Surveys authorized permanently by Legislature and predecessor to Central Sierra Snow Lab established |
| 1946 | WSC begins publication of proceedings separate from AGU |
| 1947 | Corps of Engineers introduces radio-isotope snow sensor |
| 1952 | Central Sierra Snow Lab transferred to USFS |
| 1953 | Aerial Marker snow depth program began |
| 1954 | **First Annual Coordination Meeting:** State Lakes and Mitchell Meadow telemetered snow sensors installed by the Corps |
| 1964 | First Wilderness Act passed |
| 1965 | Butyl rubber snow pillow developed and Alpha site established |
| 1968 | Sacramento Municipal Utility District installed snow sensor at Robb's Power House |
| 1973 | "Mini" version of Bulletin 120 began publication to speed delivery of forecast information |
| 1974 | Aerial Marker snow depth program largely terminated |
| 1976 | Development finished on the "metal wafer" style of snow pillow at Alpha site |
| 1980 | First GOES snow sensor sites installed at Dana Meadows, Big Meadows and Paradise |
| 1982 | No Annual Cooperator's Meeting |
| 1983 | First snow sensors installed in USFS designated wilderness areas |
| 1986 | CDEC established |
| 1987 | Computer generated copy for Bulletin 120 to reduce printing time implemented |
| 1989 | The "mini" B120 eliminated |
| 1996 | Development of the Cosmic snow sensor by Sandia National Labs began |
| 1999 | Bulletin 120 first available via internet |